(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 311 269 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: 29.05.91 Bulletin 91/22

(51) Int. Cl.[5]: B29C 45/67

(21) Application number: 88308687.8

(22) Date of filing: 20.09.88

(54) Mold clamping device.

(30) Priority: 30.09.87 JP 247027/87

(43) Date of publication of application: 12.04.89 Bulletin 89/15

(45) Publication of the grant of the patent: 29.05.91 Bulletin 91/22

(84) Designated Contracting States: AT BE CH DE ES FR GB GR IT LI LU NL SE

(56) References cited:
EP-A- 0 281 329
FR-A- 2 153 473
FR-A- 2 366 119
FR-A- 2 494 628

(73) Proprietor: NISSEI JUSHI KOGYO KABUSHIKI KAISHA
2110, Ooaza Minamijo Sakaki-machi
Hanishina-gun Nagano-ken (JP)

(72) Inventor: Shima, Yoshiharu c/o Nissei Jushi Kogyo Kabushiki
Kaisha 2110, Ooaza Minamijo Sakaki-machi
Hanishina-gun Nagano-ken (JP)

(74) Representative: Stuart, Ian Alexander et al
MEWBURN ELLIS & CO. 2/3 Cursitor Street
London EC4A 1BQ (GB)

EP 0 311 269 B1

Description

This invention relates to a mold clamping device, and particularly to a mold clamping device for an injection molding machine or a die casting machine.

In the direct pressure type mold clamping devices for injection molding machines and die casting machines, it is necessary to open or close molds at a high speed for reducing the time of the molding cycle. In addition, it is also necessary to clamp molds with a large force to oppose the molding pressure.

To satisfy these opposing requirements this particular type of mold clamping device generally has a complex structure. Further, many kinds of mold clamping devices exist.

For example, a conventional mold clamping device for a plastic injection molding machine, which has been disclosed as Japanese Patent Provisional Publication gazette 57-115329, has following structure.

Namely, there are in parallel, a plurality of liquid pressure driven cylinders for opening the mold, and a high power clamping cylinder. A single acting piston for mold clamping is fitted to a clamping ram of the clamping cylinder from the rear. The liquid pressure chambers of the liquid pressure driven cylinders are connected to the front oil chamber of the clamping cylinder. The front oil chamber and the rear oil chamber of the clamping cylinder are connected by the connecting path of the piston section of the clamping ram. The connecting path is opened or closed by a first open-close valve which is operated by oil pressure from outside.

In this mold clamping device, for mold opening or mold closure, oil in the front oil chamber of the clamping cylinder and oil in the liquid pressure driven cylinders travels via the connecting path of the piston section of the clamping ram, so that negative pressure scarcely generates in the cylinders and smooth operation can be executed. The fact that the clamping cylinder and the liquid pressure driven cylinders are in parallel advantageously reduces the total length of the device.

However, there are the following problems in the above stated mold clamping device.

(1) Because the mold opening operation is driven by the liquid pressure driven cylinders, a plurality of the liquid pressure driven cylinders must be provided on both sides of the clamping cylinder for balancing mold opening action.

(2) When the molds are opened, the oil chambers of the liquid pressure driven cylinders are pressurized so that the chambers are connected to the front and rear chambers of the clamping cylinder for oil flow. Therefore, the oil pressure affects not only the chambers of the liquid pressure driven cylinders but the front and rear chambers of the clamping cylinder so that the liquid pressure driven cylinders must have pressure proof structures. The front chamber of the clamping cylinder, which is not used for driving to open molds or to clamp them tightly, also must have a pressure proof structure. With such pressure proof structure, that device must be larger and heavier.

(3) The first open-close valve, which opens or closes the connecting path, provided in the piston section of the clamping ram is controlled in its operation by the oil path provided in the clamping ram and extending in the axial direction thereof and by the oil circuit connected to the path whose one end opens in the surface of the clamping ram located in the vicinity of a movable board and is connected to a hydraulic machine via external piping. However, with this structure, it is difficult to machine or assemble the clamping ram, and there are problems in durability and safety because of the connecting of the external piping to movable portions.

(4) Many cylinder units which need precision machining are employed, so that manufacturing steps of producing the device are numerous and the device will be expensive.

EP-A-0 281 329, which is included in the state of the art under the terms of EPC Article 54 (3), discloses a mold clamping device having a clamping cylinder slidably fitted with a clamping ram fast with a movable board, and a high speed piston which is slidably fitted in said clamping ram from the rear, the mold clamping device having :

a rear oil chamber for oil pressure being formed by a piston section of said clamping ram in said clamping cylinder ;

a first oil path for supplying oil to the rear oil chamber of said clamping cylinder ;

a connecting path passing through the piston section of said clamping ram to connect the front chamber and the rear oil chamber of said clamping cylinder ;

a open-close valve being slidably fitted on the rear end section of said clamping ram for opening said connecting path during mold closure and mold opening, and for closing said connecting path during mold clamping ;

a chamber for mold opening and a chamber for mold closure being provided in said clamping ram ;

a second oil path for supplying oil to the oil chamber for mold opening and the oil chamber for mold closure ;

an oil chamber for valve opening being formed between the slidably fitted section of said first open-close valve and said clamping ram ;

a through-hole bored in said clamping ram to connect said oil chamber for valve opening and the oil chamber for mold opening of said clamping ram to each other.

EP-A-0 281 329 also requires a support cylinder and support piston, with specified pressure relation-

ships between pressure receiving areas of the chambers of the clamping and support cylinders. The present invention shares the above features, except that it does not require the presence of a support cylinder and piston. Furthermore it requires a charge tank connected to the front oil chamber of said clamping cylinder, being provided in parallel to said clamping cylinder, and having capacity larger than the capacity difference between the front oil chamber and the rear oil chamber of said clamping cylinder ; and a second open-close valve for connecting and disconnecting the front oil chamber of said clamping cylinder and said charge tank.

Preferred embodiments of this invention may solve or ameliorate one or more of the above problems, and desirably provide a simple, compact and light mold clamping device which can execute smooth mold opening or mold closure without generating negative pressure in the clamping cylinder.

In the present invention, basically a front oil chamber and a rear oil chamber of a clamping cylinder, which are divided by a piston section of a clamping ram, are connected by a connecting path bored through the piston section of the clamping ram. With this structure, when the piston section of the clamping ram travels in the clamping cylinder for mold closure and mold opening, the oil in the front oil chamber of the clamping cylinder travels via the connecting path so that no negative pressure generates in the clamping cylinder, and mold opening and mold closure can be executed smoothly. Oil deficiency or surplus in either chamber is supplied from or returned to a charge tank.

After mold closure, when tight clamping is executed by supplying oil to the rear chamber of the clamping cylinder, the connecting path provided in the piston section of the clamping ram is closed by a first open-close valve. The operation of the first open-close valve is executed by closing a second open-close valve to pressurize the inner space of the clamping cylinder for generating an effective pressure difference across the first open-close valve. The second open-close valve is necessary to move the first open-close valve in a prescribed direction to close the connecting path of the clamping ram.

During tight clamping, oil pressure in the front oil chamber of the clamping cylinder is released by a relief valve so that the front oil chamber is kept at low pressure. Therefore, it is scarcely necessary to form the front oil chamber of the clamping cylinder and the charge tank as pressure proof structures. They experience only low pressures, so that their structures can be simple. Note that, after beginning the tight clamping operation by closing the connecting path of the piston section of the clamping ram, the second open-close valve may open to release the oil pressure in the front oil chamber of the clamping cylinder to the charge tank, therefore the relief valve can be eliminated in this case.

During mold opening, the first open-close valve is moved to open the connecting path of the piston section of the clamping ram. This movement is executed for a mold opening operation by supplying oil from an oil chamber for mold opening which is formed in the clamping ram to an oil chamber for opening the valve which is formed as a gap between the first open-close valve and the periphery of the clamping ram via a through-hole bored in the clamping ram. Therefore, an oil circuit for operating the first open-close valve can be quite simple.

Mold opening or mold closing operation by sliding the clamping ram in the clamping cylinder can be executed by using a front oil chamber for mold closure and a rear oil chamber for mold opening which are divided by a piston section of a high-speed piston slidably fitted into the clamping ram. Preferably the front chamber of the clamping ram is formed as an air chamber connected to the atmosphere, and the oil chamber for mold closure is formed in the high-speed piston by fitting a piston rod whose one end is fixed on the wall of the air chamber in the high-speed piston from front end thereof. In this case, as a result of selecting the cross sectional area of the piston rod, the effective cross sectional area of the oil chamber for mold closure and the effective cross sectional area of the oil chamber for mold closure can be equal substantially, so that the speed of mold closure and the speed of mold opening can be the same without an external switching valve, and efficiency of the molding cycle can be increased.

Embodiments of the present invention may have advantages :

(1) during mold opening and mold closure, upon moving the piston section of the clamping ram in the clamping cylinder, the oil in the clamping cylinder travels via the connecting path of the piston section of the clamping ram so that the operation of mold opening and mold closure can be smoothly executed without generating negative pressure in the clamping cylinder ;

(2) the operation of mold opening or mold closure can be executed by pressurizing only the oil chamber for mold closure or the oil chamber for mold opening in the clamping ram. For tight clamping, clamping pressure scarcely affects the front oil chamber of the clamping cylinder, so that pressure in the front oil chamber of the clamping cylinder and the charge tank is seldom generated throughout the operation cycle. Therefore, it is not necessary for the front oil chamber of the clamping cylinder and the charge tank to have pressure proof structure. Thus their structure can be simple and compact, and the device can be light and can be reduced its manufacturing cost ;

(3) the movement of the first open-close valve can be executed by supplying oil from the oil chamber

for mold opening to the oil chamber for valve opening via the through-hole bored in the clamping ram to connect the oil chamber for valve opening and the oil chamber for mold opening to each other, so that external piping can be eliminated, machining and assembling can be easier, and durablity and safety can be increased.

The preferred embodiments of the present invention will now be described by way of example with reference to the accompanying drawings in which :

Fig. 1 shows a cross sectional view of a clamping cylinder in the mold opening status ;

Fig. 2 shows an enlarged sectional view of a second open-close valve ;

Fig. 3 shows a cross sectional view of a clamping cylinder of another embodiment ; and

Fig. 4 shows a cross sectional view of a normally open type second open-close valve.

Preferred embodiments of the present invention will now be described in detail with reference to accompanying drawings as follows.

A movable board 10 is guided to move to and away from a fixed board 11 by a tie bar 13 which is spanned between the fixed board 11 and a cylinder block 12.

On each opposite face of the movable board 10 and the fixed board 11, there are provided a movable mold 14 and a fixed mold 25. On a base 16 provided at the rear side of the fixed board 11, there is provided an injection machine 17 which can be moved to and away from the fixed mold 15. On the cylinder block 12, there are, in parallel, a clamping cylinder 18 and charge tank 19.

A clamping ram 20 whose front end is connected to the rear face of the movable board 10 is slidably fitted in the clamping cylinder 18 through the front lid 9. The inner space of the clamping cylinder 18 is divided into a front chamber E (described E later) and a rear chamber B (described later) by the piston section 21 of the clamping ram 20. The chambers E and B are connected to each other by a connecting path 22 provided in the piston section 21.

The charge tank 19 is connected to the chamber E as a front oil chamber of the clamping cylinder 18. The capacity of the charge tank 19 is larger than the capacity difference between the chambers E and B of the clamping cylinder 18.

The chamber E is connected to a hydraulic machine via a relief valve 40 which is set at low pressure.

A second open-close valve 41 opens and closes an oil path 33. Namely, a valve body 42 is normally biased to contact valve seat 44 for closing an oil path 33 by a coil spring 43. The valve body 42 is moved to open the oil path 33 acting against elasticity of the coil spring 43 for connecting the charge tank 19 and the chamber E by supplying oil the the chamber D of the second open-close valve 41. An enlarged view of the second open-close valve 41 is shown in Fig. 2.

The portion of the clamping ram 20 which extends into the chamber B has a large-diameter section 23 and a small-diameter section 24 whose diameter is smaller than the large-diameter section 23. A first open-close valve 25 is fitted onto the large-diameter section 23 and the small-diameter section 24, and is also slidable in the axial direction of the clamping ram 20 to open and close the connecting path 22. The first open-close valve 25 is formed as a ring piston, and its sleeve section 26 is guided on the periphery of the large-diameter section 23. The one end face of the sleeve section 26 is capable of closing the connecting path 22. There is fixed a stop 27 to prevent the first open-close valve 25 from slipping out and to limit travelling length thereof on the small-diameter section 24. There is formed a space F (described as chamber F later) between the inner face of the sleeve section 26 of the first open-close valve 25 and the outer face of the small-diameter section 24.

There is inserted a high-speed piston 28 whose rear end is fixed on the inner rear wall of the clamping cylinder 18 in the clamping ram 20. The inner space of the clamping ram 20 is divided into an air chamber G and a chamber C for mold opening (described later) by the piston section 29 of the high-speed piston 28. The air chamber G is connected to the atmosphere via a path (not shown). The chambers C and F are connected via a through-hole bored in the clamping ram 20.

A front end of a piston rod 45, which projects from the inner bottom face of the air chamber G of the clamping ram 20, is slidably fitted in the high-speed piston 28 so that there are formed a chamber A for high speed mold closure (described the chamber A later) in the high-speed piston 28. The chambers A and C are connected to a hydraulic machine (not shown) which is provided outside of the cylinder block 12 via an oil path 47.

Switching valves (not shown), which are provided outside of the cylinder block 12, are connected to the oil paths 46 and 47 to pass the return oil from the chamber A to the oil path 47 for supplying it to the chamber C.

Note that, numeral 48 is an oil path to supply oil to the chamber B and numeral 49 is an overflow tube. Oil which overflows from the overflow tube is returned to a main tank (not shown).

Next, the action of the device will be described.

High-speed mold closure :

The chamber D is pressurized to move the valve body 42, the oil path 33 is opened, and the chamber E and the charge tank 19 are connected.

Next, the oil is supplied to the chamber A via the oil path 46 to execute high speed mold closure. When the piston section 21 of the clamping ram 20 travels

in the chamber E, the oil in the chamber E is introduced into the chamber B via the connecting path 22. Any lack of oil caused by size difference between the chambers B and E is made up for from the charge tank 19, so that the chamber B will not be at negative pressure, and high speed mold closure can be executed.

Note that the chambers E and B and the charge tank 19 are not pressurized so that the first open-close valve 25 has been moved to open the connecting path 22 by oil resistance caused by moving the piston section 21 of the clamping ram 20.

Tight clamping :

Following the high speed mold closure caused by pressurizing the chamber A, the oil amount which is supplied to the chamber is reduced and the mold is closed at low speed and at low pressure.

Next, the chamber D is opened, the valve body 42 is pushed to the valve seat 44 by the elasticity of the coil spring 43 to close the oil path 33, and then the oil is supplied to the chamber B via the oil path 48 to pressurize. Therefore, there is generated pressure difference between both sides of the first open-close valve 25 so that the first open-close valve 25 advances and the end face of the sleeve section 26 contacts the piston section 21 of the clamping ram 20 to close the connecting path 22. Then the oil supplied to the chamber B acts on the rear end face of the clamping ram 20 to execute tight clamping. In this case, if the chamber A is pressurized simultaneously, output of the chamber A also acts for tight clamping.

Note that the pressure in the chamber E has been released by the relief valve 40 to keep at low pressure.

Keeping the tight clamping status, the injection machine 17 is advanced, and resin melt is injected into the molds, and after cooling and solidification, the next manufacturing step will be executed.

Note that since the chamber E is only at low pressure, the front lid 9 need not to have high hardness. It can be of simple structure.

When the oil is supplied to the chamber B for tight clamping, the second open-close valve 41 is closed to generate effective pressure in the chambers B and E. With this generating effective pressure, pressure difference between both sides of the first open-close valve 25 is generated, and the first open-close valve 25 is moved to close the connecting path 22. The chamber B is kept at low pressure by the action of the relief valve 40 until closing the connecting path 22. After closing the connecting path 22, the chamber B is pressurized for tight clamping.

High pressure mold opening :

Upon stopping pressurizing in the chambers A and B, the pressure is released, the chamber D is pressurized to open the second open-close valve 41, and the chamber E and the charge tank 19 is connected by the oil path 33. Next, the oil is supplied to the oil path 47 to pressurize the chamber C for high pressure mold opening.

At that time, the chamber C is pressurized and then the chamber F is pressurized by the through-hole 32, so that the first open-close valve 25 is retracted to connect the chambers E and B via the connecting path 22, and the oil in the chamber B is returned to the chamber E and the charge tank 19.

Further, the oil returned from the chamber A is introduced to the oil path 47 via the oil path 46 and the switching valve (not shown), so that mold opening operation is accelerated to equalize the speed of mold opening to the speed of mold closure.

Note that if the effective cross sectional area of the chambers A and C are designed to be equal, the speed of mold opening and the speed of mold closure can be equal without the switching valve.

Another embodiment is shown in Fig. 3.

In this embodiment, elements which are the same as former embodiment are indicated by same numerals of the former, and explanation will be omitted.

A front oil chamber and a rear oil chamber of a clamping ram 20 are divided by a piston section 29 of a high speed piston 28, and the front oil chamber is formed as a chamber A for high speed mold closure ; the rear oil chamber is formed as a chamber C for mold opening.

The chambers A and C are connected to a hydraulic machine (not shown) provided outside of a cylinder block 12 via oil paths 46 and 47. A switching valve (not shown), which is provided outside of the cylinder block 12, is connected to the oil paths 46 and 47 to introduce the return oil from the chamber C to the oil path 47 for supplying to the chamber A.

In this embodiment, a chamber E is connected to an oil tank 52 by a spring check valve 50 and a check valve 51 which are arranged in parallel, and which allow the oil pass in opposite directions.

Therefore, in the device in this embodiment, high speed mold closure is executed by supplying the oil from the oil path 46 to the chamber A. And high speed mold opening is executed by supplying the oil from the oil path 47 to the chamber C. During mold opening, the return oil from the chamber A is introduced to the oil path 47 via the oil path 46 and the switching valve (not shown), so that the speed of mold opening is accelerated to equalize the speed of mold opening to the speed of mold closure.

The spring check valve 50 releases the oil in the chamber E which is compressed during tight clamping to the oil tank 52 to keep the chamber E at low pressure, so it works as a safety valve. On transferring from tight clamping to mold opening with release of the pressure in the chamber B, the check valve 51 prevents the chamber E from being negative in a moment

by sucking oil which escaped from the chamber E during tight clamping from the oil tank 52.
Therefore, smooth mold opening can be executed.

Note that oil is introduced from the charge tank 19 to the chamber E during mold opening so the check valve 51 can be eliminated.

A second open-close valve 41 can be a normally open type valve as shown in Fig. 4. In this case, it can be controlled as to open or closed status in a similar manner to the former embodiment. If the second open-close valve 41 is a normally open type, the oil is introduced quite smoothly from the charge tank 19 to the chamber E so that the check valve 51 can be eliminated.

Claims

1. A mold clamping device having a clamping cylinder (18) slidably fitted with a clamping ram (20) whose front end is fast with a movable board (10), and a high speed piston (28) which is slidably fitted in said clamping ram (20) from the rear, the mold clamping device having :

a rear oil chamber (B) for oil pressure being formed by a piston section (21) of said clamping ram (20) in said clamping cylinder (18) ;

a first oil path (48) for supplying oil to the rear oil chamber (B) of said clamping cylinder ;

a connecting path (22) passing through the piston section (21) of said clamping ram to connect the front chamber (E) and the rear oil chamber (B) of said clamping cylinder (18) ;

a first open-close valve (25) being slidably fitted on the rear end section of said clamping ram (20) for opening said connecting path (22) during mold closure and mold opening, and for closing said connecting path during mold clamping ;

a chamber for mold opening (C) and a chamber for mold closure (A) being provided in said clamping ram (20) ;

a second oil path (46, 47) for supplying oil to the oil chamber for mold opening (C) and the oil chamber for mold closure (A) ;

an oil chamber for valve opening (F) being formed between the slidably fitted section of said first open-close valve (25) and said clamping ram ;

a through-hole (32) bored in said clamping ram to connect said oil chamber for valve opening (F) and the oil chamber for mold opening (C) of said clamping ram to each other ;

a charge tank (19), being connected to the front oil chamber (E) of said clamping cylinder (18), being provided in parallel to said clamping cylinder (18), and having capacity larger than the capacity difference between the front oil chamber (E) and the rear oil chamber (B) of said clamping cylinder (18) ; and

a second open-close valve (41) for connecting and disconnecting the front oil chamber (E) of said clamping cylinder and said charge tank (19).

2. A mold clamping device according to claim 1, wherein said first open-close valve (25) is formed as a ring piston which is slidably fitted on a large-diameter section (23) and a small-diameter section (24) provided at rear end section of said clamping ram (20) which projects into the rear oil chamber (B) of said clamping cylinder (18), said connecting path provided in the piston section of said clamping ram (22) is openable and closable by the end face of the sleeved section of the ring piston (25) which can slide on the large-diameter section (23) of said clamping ram ; and the space between the inner face of the ring piston (25) and the outer face (24) of the small-diameter section of said clamping ram is formed as the oil chamber (F) for valve opening.

3. A mold clamping device according to claim 1 or 2, wherein said second open-close valve (41) is arranged to be opened to connect the front oil chamber (E) of said clamping cylinder (18) and said charge tank (19) when oil is supplied to the oil chamber of mold closure (A) of said clamping ram and when oil is supplied to the oil chamber for mold opening (C) thereof, and said second open-close valve (41) closes an oil path (33) between the front oil chamber (E) of said clamping cylinder and said charge tank (19) when oil is supplied to the rear chamber (B) of said clamping cylinder (18).

4. A mold clamping device according to claim 1,2 or 3, further comprising a relief valve (40) to keep the front oil chamber (E) of said clamping cylinder at low pressure.

5. A mold clamping device according to claim 1,2 or 3, wherein the front oil chamber (E) of said clamping cylinder is connected to an oil tank (52) by a spring check valve (50) for releasing oil to the oil tank to keep the front oil chamber at low pressure and a second check valve (51) which is provided in parallel with the spring check valve (50) and passes oil in the opposite direction.

6. A mold clamping device according to claim 1,2,3,4 or 5, wherein said clamping ram (20) has an inner space divided into the front oil chamber (A) for mold closure and the rear oil chamber for mold opening (C) by a large-diameter piston section (29) of a high speed piston (28).

7. A mold clamping device according to claim 1, 2, 3, 4 or 5, wherein said clamping ram (20) has an inner space divided into a front air chamber (G) and a rear oil chamber (C) for mold opening by a large-diameter piston section (29) provided at the front end of a high speed piston (28), and a piston rod (45) extends from the inner wall of the air chamber (G) of said clamping ram and is fitted in said high speed piston from the front end side thereof to form the oil chamber (A) for mold closure therein.

8. A mold clamping device according to claim 7,

wherein the effective cross sectional area of the oil chamber (C) for mold opening of said clamping ram (20) is substantially equal to the effective cross sectional area of the oil chamber for mold closure (A) of said high speed piston (28).

Ansprüche

1. Eine Formschließvorrichtung mit einem Schließzylinder (18) mit einem verschiebbar aufgenommenen Schließstempel (20), dessen vorderes Ende fest mit einer beweglichen Platte (10) ist, und mit einem Hochgeschwindigkeitskolben (28), welcher von hinten in den Schließstempel (20) verschiebbar eingebaut ist, wobei die Formschließvorrichtung besitzt: eine hintere Ölkammer (B) für den durch einen Kolbenabschnitt (21) des Schließstempels (20) im Schließzylinder (18) gebildeten Öldruck; einen ersten Ölpfad (48) zum Zuführen von Öl zur hinteren Ölkammer (B) des Schließzylinders; einen Verbindungsfad (22), der durch den Kolbenabschnitt (21) des Schließstempels geht, um die vordere Kammer (E) und die hintere Ölkammer (B) des Schließzylinders (18) zu verbinden; ein, am hinteren Endabschnitt des Schließstempels (20) verschiebbar aufgenommenes Auf-zu-Ventil (25) zum Öffnen des Verbindungspfades (22) während des Formwerkzeugschließens und Formwerkzeugöffnens und zum Schließen des Verbindungspfades während des Zuhaltens des Formwerkzeuges; wobei in dem Schließstempel (20) eine Kammer (C) zum Formwerkzeugöffnen und eine Kammer (A) zum Formwerkzeugschließen vorgesehen sind; einen zweiten Ölpfad (46, 47) zum Zuführen von Öl zu der Ölkammer (C) zum Formwerkzeuföffnen und der Ölkammer (A) zum Formwerkzeugschließen; eine Ölkammer (E) zum Ventilöffnen, die zwischen dem verschiebbar aufgenommenen Abschnitt des erstens Auf-zu-Ventiles (25) und dem Schließstempel gebildet ist; ein Durchgangsloch (32), welches in den Schließstempel gebohrt ist, um die Ölkammer (F) zum Ventilöffnen und die Ölkammer (C) zum Formwerkzeugöffnen des Schließstempels untereinander zu verbinden; einen Fülltank (19), der mit der vorderen Ölkammer (E) des Schließzylinders (18) verbunden ist, parallel zum Schließzylinder (18) angeordnet ist und eine Kapazität besitzt, die größer ist, als die Kapazitätsdifferenz zwischen vorderer Ölkammer (E) und hinterer Ölkammer (B) des Schließzylinders (18); und ein zweites Auf-zu-Ventil (41) zum Verbinden und Trennen der vorderen Ölkammer (E) des Schließzylinders und des Fülltanks (19).

2. Eine Formschließvorrichtung gemäß Anspruch 1, wobei ein erstes Auf-zu-Ventil (25) als Ringkolben ausgebildet ist, welcher auf einem Abschnitt (23) mit großem Durchmesser und einem Abschnitt (24) mit kleinem Durchmesser verschiebbar aufgenommen ist, welche am hinteren Endabschnitt des Schließstempels (20) vorgesehen sind, welcher in die hintere Ölkammer (B) des Schließzylinders (18) ragt, wobei der im Kolbenabschnitt des Schließstempels (22) vorgesehene Verbindungspfad durch eine Endfläche des Hülsenabschnittes des Ringkolbens (25), der auf dem Abschnitt (23) mit großem Durchmesser des Schließstempels gleiten kann, öffenbar und schließbar ist, und wobei der Raum zwischen der Innenfläche des Ringkolbens (25) und der äußeren Fläche (24) des Abschnittes mit kleinem Durchmesser des Schließstempels als eine Ölkammer (F) zum Formwerkzeugöffnen ausgebildet ist.

3. Eine Formschließvorrichtung gemäß Anspruch 1 oder 2, wobei das zweite Auf-zu-Ventil (41) zum Verbinden der vorderen Ölkammer (E) des Schließzylinders (18) und des Fülltanks (19) öffenbar ist, wenn Öl der zum Formwerkzeugschließen vorgesehen Ölkammer (A) des Schließstempels zugeführt wird und wenn Öl dessen zum Formwerkzeugöffnen vorgesehener Ölkammer (C) zugeführt wird, und das zweite Auf-zu-Ventil (41) einen Ölpfad (33) zwischen vorderer Ölkammer (E) des Schließzylinders und Fülltank (19) schließt, wenn Öl der hinteren Kammer (B) des Schließzylinders (18) zugeführt wird.

4. Eine Formschließvorrichtung gemäß Anspruch 1, 2 oder 3, welche ferner ein Entlastungsventil (40) aufweist, um die vordere Ölkammer (E) des Schließzylinders auf niedrigem Druck zu halten.

5. Eine Formschließvorrichtung gemäß Anspruch 1, 2 oder 3, wobei die vordere Ö (E) des Schließzylinders mit einem Öltank (52) durch ein Rückschlagventil (50) mit Feder verbunden ist, um Öl zum Öltank ablaufen zu lassen, um die vordere Ölkammer auf niedrigem Druck zu halten, und durch ein zweites Rückschlagventil (51), welches parallel zum Rückschlagventil (50) mit Feder angeordnet ist und Öl in die entgegengesetzte Richtung durchchläßt.

6. Eine Formschließvorrichtung gemäß Anspruch 1, 2, 3, 4 oder 5, wobei der Schließstempel einen, durch einen Kolbenabschnitt (29) mit großem Durchmesser eines Hochgeschwindigkeitskolbens (28) in die zum Formwerkzeugschließen vorgesehene vordere Ölkammer (A) und in die zum Formwerkzeugöffnen vorgesehene hintere Ölkammer (C) geteilten Innenraum besitzt.

7. Eine Formschließvorrichtung gemäß Anspruch 1, 2, 3, oder 5, wobei der Schließstempel (20) einen, durch einen am vorderen Ende eines Hochgeschwindigkeitskolbens (28) vorgesehen Kolbenabschnitt (29) großen Durchmessers in eine vordere Luftkammer (G) und eine hintere Ölkammer (C) zum Formwerkzeugöffnen geteilten Innenraum besitzt, und eine Kolbenstange (45) sich von der inneren Wand der Luftkammer (G) des Schließstempels erstreckt und in dem Hochgeschwindigkeitskolben von dessen vorderer Endseite her aufgenommen ist, um darin die Ölkammer (A) zum Formwerkzeugschließen zu bil-

den.

8. Eine Formschließvorrichtung gemäß Anspruch 7, wobei die wirksame Querschnittsfläche der zum Formwerkzeugöffnen vorgesehen Ölkammer (C) des Schließstempels (20) im wesentlichen gleich der wirksamen Querschnittsfläche der zum Formwerkzeugschließen vorgesehen Ölkammer (A) des Hochgeschwindigkeitskolbens (28) ist.

Revendications

1. Dispositif de serrage de moule comprenant un vérin de serrage (18) équipé de façon coulissante d'un coulisseau de serrage (20) dont l'extrémité avant est solidaire d'une plaque mobile (10), et d'un piston à grande vitesse (28) qui est monté de façon coulissante dans ledit coulisseau de serrage (20) par l'arrière, le dispositif de serrage de moule comprenant :

une chambre à huile arrière (B) pour l'huile sous pression, qui est formée par la section de piston (21) dudit coulisseau de serrage (20) dans ledit vérin de serrage (18) ;

un premier passage d'huile (48) pour envoyer l'huile à la chambre à huile arrière (B) dudit vérin de serrage ;

un passage de liaison (22) qui passe par la section de piston (21) dudit coulisseau de serrage pour relier la chambre avant (E) à la chambre à huile arrière (B) dudit vérin de serrage (18) ;

une première soupape d'ouverture-fermeture (25) montée de façon coulissante sur la section d'extrémité arrière dudit coulisseau de serrage (20) pour ouvrir ledit passage de liaison (22) pendant la fermeture du moule et pendant l'ouverture du moule, et pour fermer ledit passage de liaison pendant le serrage du moule ;

une chambre (C) destinée à l'ouverture du moule et une chambre (A) destinée à la fermeture du moule étant prévues dans ledit coulisseau de serrage (20) ;

un second passage d'huile (46, 47) pour envoyer l'huile à la chambre à huile (C) destinée à l'ouverture du moule et la chambre à huile (A) destinée à la fermeture du moule ;

une chambre à huile (F) destinée à l'ouverture de la soupape, formée entre la section montée de façon coulissante de ladite première soupape d'ouverture-fermeture (25) et ledit coulisseau de serrage ;

un trou traversant (32) percé dans ledit coulisseau de serrage pour relier l'une à l'autre ladite chambre à huile (F) destinée à l'ouverture de la soupape et la chambre à huile (C) destinée à l'ouverture du moule dudit coulisseau de serrage.

2. Dispositif de serrage de moule selon la revendication 1, dans lequel ladite première soupape de sûreté (25) est formée à la manière d'un piston annulaire monté de façon coulissante entre une section de grand diamètre (23) et une section de petit diamètre (24) prévues dans la section d'extrémité arrière dudit coulisseau de serrage (20) qui fait saillie dans la chambre à huile arrière (B) dudit vérin de serrage (18), ledit passage de liaison prévu dans la section de piston dudit coulisseau de serrage (2) pouvant être ouvert et fermé par la face d'extrémité de la section en manchon du piston annulaire (25) et peut coulisser sur la section de grand diamètre (23) dudit coulisseau de serrage ; et l'espace entre la face interne du piston annulaire (25) et la face externe (24) de la section de petit diamètre dudit coulisseau de serrage est formée sous forme d'une chambre à huile (F) pour l'ouverture de la soupape.

3. Dispositif de serrage de moule selon la revendication 1 ou 2, dans lequel ladite seconde soupape d'ouverture-fermeture (41) est prévue pour être ouverte et relier la chambre à huile avant (E) dudit vérin de serrage (18) audit réservoir de charge (19) quand l'huile est envoyée dans la chambre à huile (A) dudit coulisseau de serrage qui est destinée à la fermeture du moule et quand l'huile est envoyée dans la chambre à huile (C) de ce coulisseau qui est destinée à l'ouverture du moule, et ladite seconde soupape d'ouverture-fermeture (41) ferme un passage d'huile (33) entre la chambre à huile avant (E) dudit vérin de serrage et ledit réservoir de charge (19) quand l'huile est envoyée dans la chambre arrière (B) dudit vérin de serrage (18).

4. Dispositif de serrage de moule selon l'une quelconque des revendications 1 à 3, comprenant en outre une soupape de sûreté (40) pour maintenir la chambre à huile avant (E) dudit vérin de serrage sous une faible pression.

5. Dispositif de serrage de moule selon l'une quelconque des revendications 1 à 3, dans lequel la chambre à huile avant (E) dudit vérin de serrage est reliée à un réservoir d'huile (52) par une soupape de sûreté à ressort (50) pour envoyer l'huile vers le réservoir d'huile et maintenir la chambre à huile avant sous une faible pression, et une seconde soupape de sûreté (51) qui est montée en parallèle avec la soupape de sûreté à ressort (50) et fait passer l'huile dans le sens opposé.

6. Dispositif de serrage de moule selon l'une quelconque des revendications 1 à 5, dans lequel ledit coulisseau de serrage (20) comprend un espace interne subdivisé en la chambre à huile avant (A) de fermeture du moule et la chambre à huile arrière (C) d'ouverture du moule par une section de piston de grand diamètre (29) d'un piston grande vitesse (28).

7. Dispositif de serrage de moule selon l'une quelconque des revendications 1 à 5, dans lequel ledit coulisseau de serrage (20) comprend un espace interne subdivisé en une chambre à air avant (G) et une chambre à huile arrière (C) d'ouverture du moule par une section de piston de grand diamètre (29) prévue à l'extrémité avant d'un piston grande vitesse

(28), et une tige de piston (45) s'étend depuis la paroi interne de la chambre à air (G) dudit coulisseau de serrage et est montée dans ledit piston grande vitesse à partir de son côté d'extrémité avant pour former à l'intérieur la chambre à huile (A) de fermeture du moule.

8. Dispositif de serrage de moule selon la revendication 7, dans lequel l'aire en section effective de la chambre à huile (C) d'ouverture du moule dudit coulisseau de serrage (20) est sensiblement égale à l'aire en section effective de la chambre à huile (A) de fermeture du moule dudit piston grande vitesse (28).

FIG.1

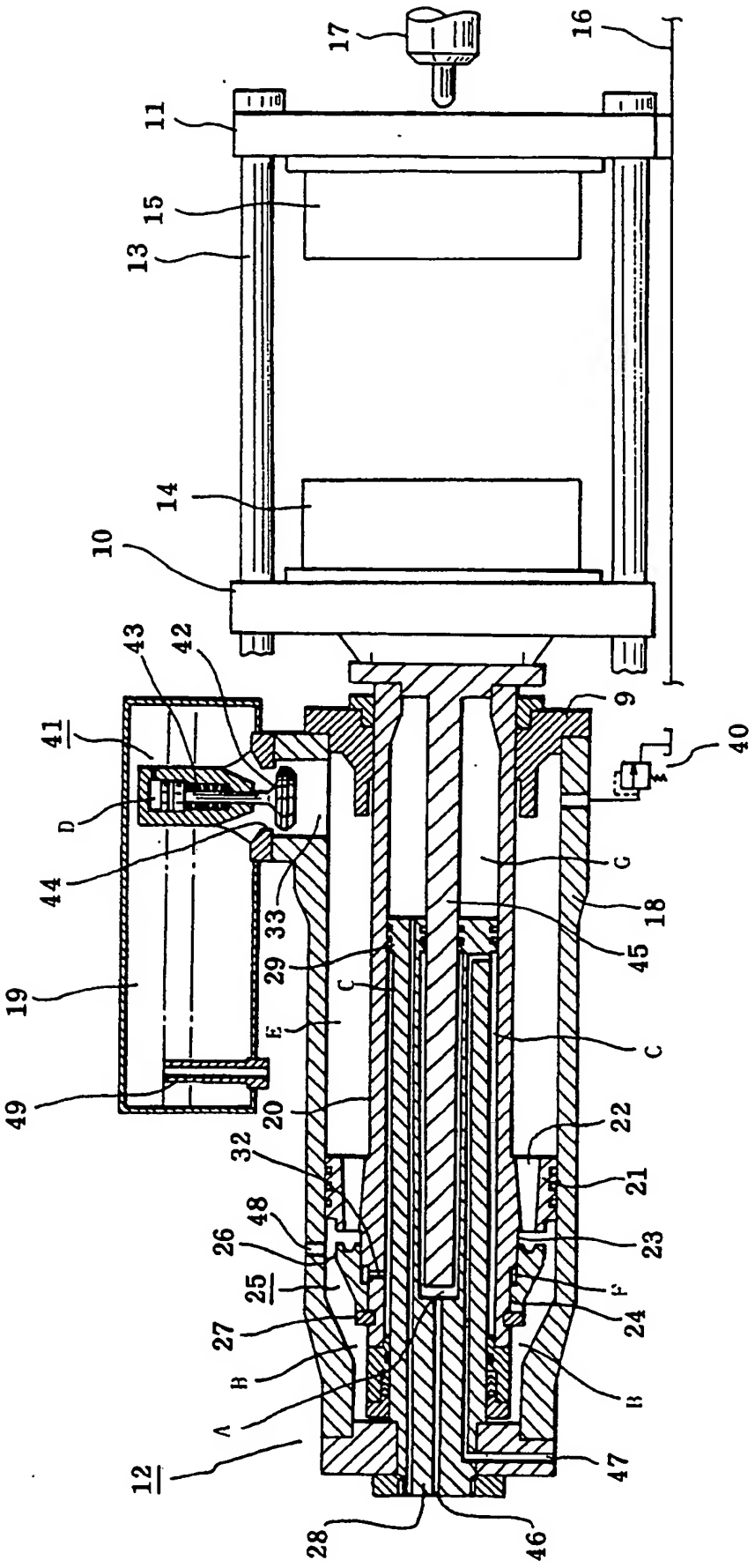

17
16
11
15
13
14
10
43
42
41
D
44
33
29
C
E
19
49
20
32
48
26
25
27
B
A
12
28
46
47
B
24
F
23
21
22
C
18
45
C
9
40

FIG. 2

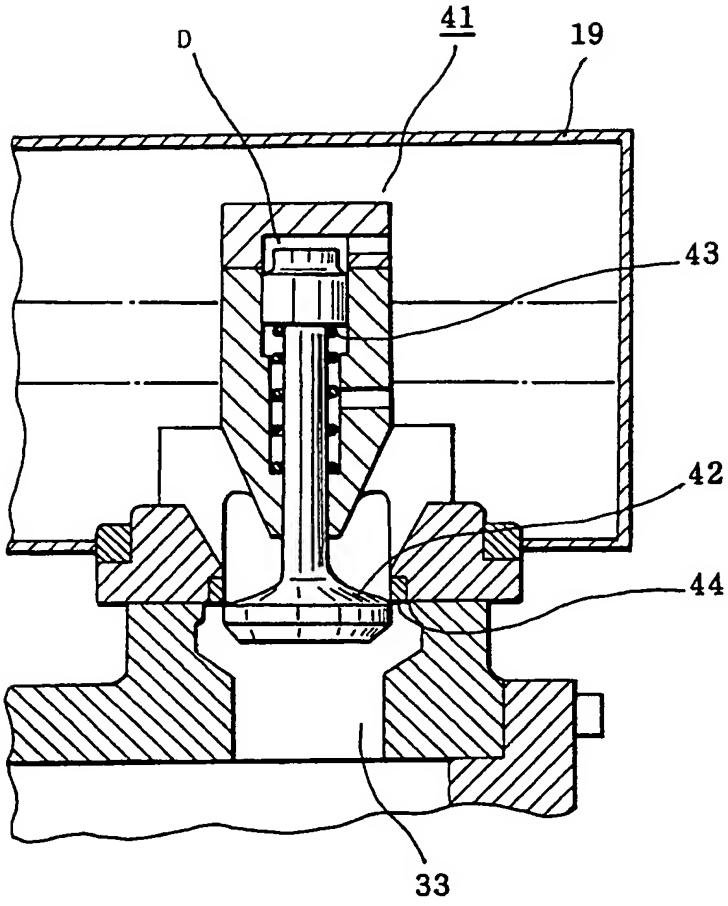


FIG.3

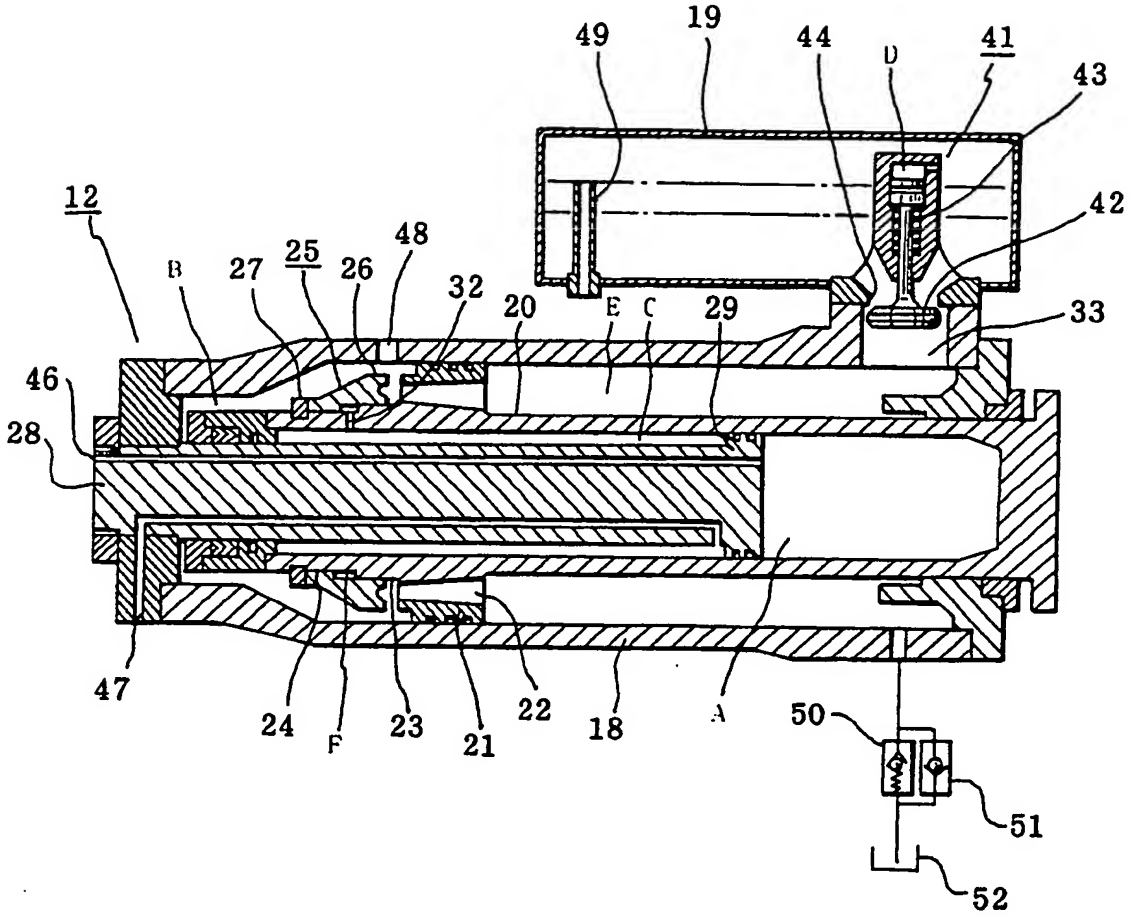
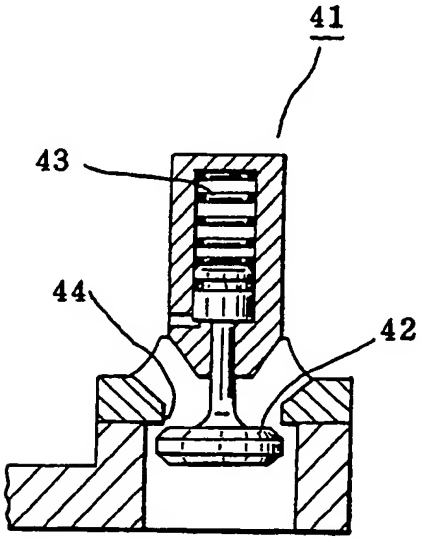

49
19
44
D
41
43
42
12
B
27
25
26
48
32
20
E
C
29
33
46
28
47
24
F
23
21
22
18
A
50
51
52

FIG.4


41
43
44
42